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DNR photo by Scott Myers



DNR photo by Mark Dwyer

**Above right:** At a drug lab collection station, the chemicals used to create methamphetamine are carefully disposed of.

**Above:** A fuchsia tide washes over Missouri's hillsides each spring as the redbuds bloom.



**MISSOURI**  
resources

**Front Cover:** Nearly 200 years ago, explorers Meriwether Lewis and William Clark passed this spot on the Missouri River near Hartsburg.

**Back Cover:** The devil blows hot and cold in Missouri with ovens and places like Devil's Icebox at Rock Bridge Memorial State Park.

Cover photos by Scott Myers



## *Current History*

### **Recalling Lewis and Clark's River Adventure**

by James M. Denny



Explorers Meriwether Lewis (holding rifle), William Clark (in uniform) and other members of the Corps of Discovery are depicted in this mural at the Missouri State Capitol. In front is Clark's lifelong servant and friend, York. It is among the collection of murals that highlights Missouri's history. MO State Archives photo of Victor Higgins' mural "Lewis and Clark at the Mouth of the Osage River."

Thus began the greatest expedition of exploration and discovery in American history. On May 14, 1804, the Corps of Discovery, led by Meriwether Lewis and William Clark, started up the Missouri River. Two years and four months later, on Sept. 23, 1806, they ended their 8,000-mile round-trip journey at St. Louis, where all 1,000 citizens of the town turned out to give the returning expedition three rousing cheers.

Our nation is now coming up on the 200th anniversary of the expedition that President Thomas Jefferson authorized to explore the unknown reaches of the newly acquired Louisiana Purchase. Per Jefferson's instructions, Lewis and Clark were to follow the Missouri River to its source and proceed to the Pacific coast. Along the way, the co-captains were to make detailed observations of the plants, animals, American Indian tribes and geography they encountered. All of this Lewis and Clark did in magnificent fashion.

Although the kick-off of the bicentennial of this great American epic of exploration is still four years off, preparations for the commemoration of this national event are well under way in Missouri and the 10 other states that lie along the Lewis and Clark National Historic Trail. An event so important as the bicentennial of the Lewis and Clark Expedition is bound to inspire a national commemoration on a scale worthy of the original journey, and the Lewis and Clark Bicentennial Council is coordinating activities at the national level.

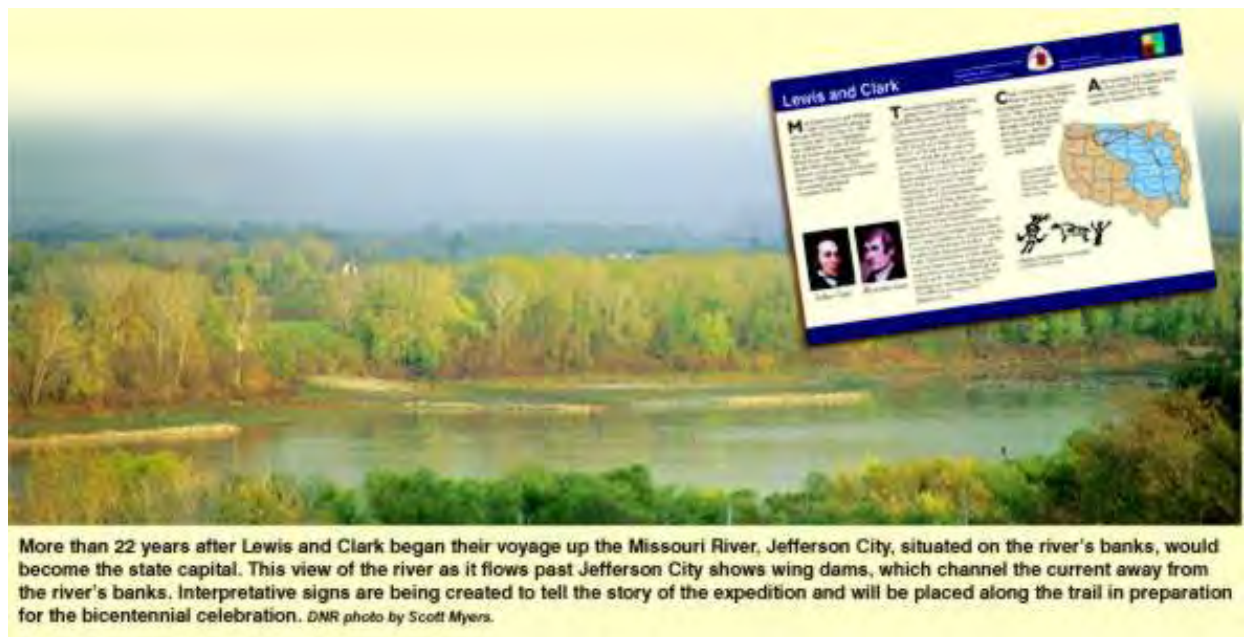
In March 1998, the late Gov. Mel Carnahan created the Missouri Lewis and Clark Bicentennial Commission. The mission set forth in the governor's executive order stipulated that the commission not only would promote public awareness, but rekindle the spirit of discovery, achievement and wonder the

expedition fostered. The commission is seeking to meet that challenge to ensure that Missouri is in the forefront of this national commemoration.

Though the commemoration is still a few years off, interest in Lewis and Clark is continuing to build, thanks to Stephen Ambrose's best-selling book, "Undaunted Courage," and the popular Ken Burns-Dayton Duncan PBS documentary, "Lewis & Clark: The Journey of the Corps of Discovery." Both have helped bring the expedition to life for millions of people. Estimates of the potential number of tourists who will retrace some portion of the Lewis and Clark journey have ranged as high as 10 percent of the nation's population - that amounts to some 28 or 30 million people heading our way. Jim Crabtree, who recently was appointed executive director of the Missouri Lewis and Clark Bicentennial Commission, is convinced there will be an enthusiastic public response to the approaching event. "We are really uncertain how many tourists will travel to our state; however, we know Missouri will be presented with an unprecedented opportunity to showcase its rich heritage and beautiful scenery before a worldwide audience. Visitors will come and we are going to make sure that they have plenty of quality opportunities to follow in the steps of Lewis and Clark and discover what Missouri has to offer."

The Missouri Department of Natural Resources hosts the executive offices of the Missouri Lewis and Clark Bicentennial Commission. The commission offices are on the first floor of the historic Lohman Building, above the museum and visitor center of the [Jefferson Landing State Historic Site](#). Department of Natural Resources Director Steve Mahfood, who serves as a member of the commission, appreciates the challenge ahead. "There are several major tasks we have to get done for Missouri to stage a first-class Lewis and Clark commemoration," said Mahfood. "We have a lot of agencies, organizations and people with all kinds of talents working together at the local, state and national levels to make sure Missouri is a major Lewis and Clark destination and that we have plenty of interesting attractions for everyone who participates."

An agencies committee of the Lewis and Clark Bicentennial Commission exists to enable participating state and federal agencies to coordinate their plans for the commemoration. Department of Natural Resources' staff have been working closely with their counterparts in the Missouri Department of Conservation, Missouri Department of Transportation, State Archives, the U.S. Army Corps of Engineers, the U.S. Department of Interior, the U.S. Fish and Wildlife Service and other agencies to address a variety of common issues pertaining to the commemoration.



One of the tasks being sponsored by the commission is the Lewis and Clark expedition interpretive signs plan. The signs will tell the story of the Lewis and Clark Expedition along the banks of the state's great rivers, the Mississippi and Missouri, where it actually unfolded. The typical sign will be a 42-inch-wide-

by-24-inch-high panel with text, maps and illustrations. Because the plan is statewide in scope, it will present a sequential unfolding of the Lewis and Clark journey across Missouri. A companion brochure will furnish complete maps and directions to the sign locations, as well as information on the progress of the expedition on the Mississippi River (Nov. 22 through Dec. 12, 1803) and on the Missouri River (May 14 through June 18, 1804, and Sept. 9 through 23, 1806). The National Park Service has approved the interpretive signs plan and all signs will be designed in accordance with its standards. When installed, the new signs will become certified sites on the Lewis and Clark National Historic Trail. To date, the signs project has received approximately \$90,000 from National Park Service grants. Installation of the signs should begin this year.

Along Katy Trail State Park and at five other state parks and historic sites, at 34 conservation areas and fishing accesses and at 17 riverside city and county parks, there will be interpretive signs discussing what was happening with the expedition as it passed by. "Placing signs across the state is a good way to introduce people to Missouri's role in the expedition," said Ann Rogers. Rogers contributes her considerable expertise on the expedition as a member of the commission. She is widely known as the author of "Lewis and Clark in Missouri," about the Corps of Discovery's journey through Missouri. "Reading the journal accounts and traveling the route the explorers followed convinced me that the Missouri chapter in the story of Lewis and Clark deserves to be known and shared," Rogers added.

[Katy Trail State Park](#) enjoys the unique status of being the longest nonmotorized segment on the Lewis and Clark National Historic Trail. For 165 miles, the Katy Trail winds its way along the Missouri River from St. Charles County to Boonville. According to Douglas Eiken, director of the department's Division of State Parks, "A series of 18 signs spaced along the trail will present the story of the expedition on a day-by-day basis. Moving from sign to sign by foot, wheelchair or bicycle will be an ideal pace for enjoying the landscape Lewis and Clark saw and admired." Katy Trail interpretive signs will cover the first 27 days of the expedition, May 14 through June 9, 1804, and the last six days, Sept. 18 through 23, 1806, of the triumphant return. Information depots at major towns and trailheads also will contain panels about the expedition.

There are several historic and picturesque towns along the Katy Trail near stopping points for the expedition. Marthasville in Warren County is a stone's throw from the tiny village of La Charette, the westernmost settlement on the Missouri River in Lewis and Clark's time. When the expedition stopped at La Charette on May 25, 1804, Clark described their friendly reception from the people of the humble little village: "The people at this Village is pore, houses Small, they Sent us milk & eggs to eat." The expedition spent another night at La Charette on the return voyage. As they pulled up to the village on Sept. 20, 1806, the explorers fired a three-round salute to the astonished but overjoyed villagers who had long given them up for lost.

Rocheport, a charming old town of pre-Civil War homes, restaurants, wineries, antique shops and bed-and-breakfast establishments, is the location of the only tunnel on the Katy Trail. The bluff through which the tunnel passes was a place where American Indians mined flint and painted sacred images on the bluff faces. Clark noted in his June 8, 1804, journal entry that the party was unable to inspect pictographs on the bluff at close hand due to the presence of a den of "verry large" rattlesnakes. Those images probably were blasted away by the railroad, but one image from another pictograph group can be seen above Lewis and Clark Cave, five miles south of Rocheport along the Katy Trail. Along this scenic stretch, the trail runs between the river and the sheer walls of some of the most spectacular bluffs along the lower Missouri River valley. Explorers called these bluffs the Big Manitou Bluffs. They were the last tall bluffs the expedition would encounter on the river until they reached present-day Montana.

State parks along the Lewis and Clark route of travel will offer dramatic settings for interpretive signs. The overlook at [Trail of Tears State Park](#) presents one of the most dramatic views of the Mississippi River between St. Louis and Cape Girardeau. Meriwether Lewis mentioned the high cliffs that came into view on the west bank upstream from Cape Girardeau as the pre-expedition passed by on Nov. 24, 1803. Trail of Tears State Park is situated along the high bluffs and steep valleys of this beautiful wooded country.

At [Weston Bend State Park](#), an overlook offers a sweeping vista of the Missouri River flowing below. A Lewis and Clark interpretive sign will be located there as well. The park is set in the rolling hill country north of Kansas City. Expedition hunter and interpreter George Drouillard walked through this country on July 2, 1804, and described it to Clark as having very fine lands, springs and deer signs "so numerous as to not be worth mentioning."

In Lewis and Clark's time, the Missouri River was filled with dangerous, boat-devouring snags and currents so swift that the keelboat had to be dragged through rapids with a tow rope.



A well-manicured overlook at [Arrow Rock State Historic Site](#) provides a panoramic view of the Missouri River and is an ideal site for an interpretive sign explaining what happened on June 9, 1804. The expedition passed this spot – Clark called it Prairie of Arrows – almost two weeks after nearly losing the keelboat at a place he called Retrograde Bend, located a few miles downstream from Washington. At that time, Clark commented that "nothing saved the boat but ... " and let the sentence dangle unfinished. That time they were saved more by luck than skill.

An incident near Arrow Rock State Historic Site demonstrated how quickly the Lewis and Clark expedition members had to learn to navigate the river.

A few miles upstream from Arrow Rock, the keelboat encountered yet another dangerous spot on the river. It became stuck on a submerged log and would have been carried into deadly snags had not the men leaped from the boat and pulled it off to safety in a matter of minutes. Clark concluded his entry by proclaiming, "I can Say with Confidence that our party is not inferior to any that was ever on the waters of the Missoppie (Mississippi)."

Five days later, near present-day Miami, the expedition went through a stretch of river that Clark considered to be the worst yet. The keelboat got caught crossways in rapids washing across a huge sandbar and would have overturned but for "Some extrodany (extraordinary) exertions of our party ever ready to inconture (endure) any fatigue for the premotion (promotion) of the enterprise."

It was in Missouri that Lewis and Clark first exhibited the leadership skills that produced one of the most successful scientific and diplomatic expeditions in history. It was here that the men they selected developed the spirit and hardihood that would carry them through the later feats of endurance that have become legendary – the three-week-long portage around the Great Falls or snowy treks across the Bitterroot Mountains, following the Lolo Trail.

When Thomas Jefferson acquired the Louisiana Purchase, he doubled the size of the United States. Jefferson believed that the backbone of America's democracy was the small yeoman farmer living on his own piece of land. As long as America remained a land of small farmers, he believed the country could

avoid the revolution and social upheaval that convulsed Europe. Missouri is a perfect state to drive through and see how life based on the family farm is faring 200 years after Lewis and Clark first saw its great rivers and beautiful spaces. As Department of Natural Resources Director Mahfood put it: "Anyone following the trail of Lewis and Clark interpretive signs along our scenic river roads will be able to see for themselves that Jefferson's dream is alive and well in Missouri."

*James M. Denny is a historian with the department's [Division of State Parks](#).*



## Director's Comment



It's that time of year again that we all look forward to – spring. I love the sunshine, the fresh air, the signs of new green life poking through the soil. Some of my earliest memories are of being outdoors and running around with my friends and family, enjoying the break from the long winter weather.

So, I guess it's not surprising that one thing I look forward to the most, both personally and professionally, is kicking off a new season at Missouri state parks. This year is even more special than most because we just announced a new state park at the confluence of the Missouri and Mississippi rivers. This 202-acre park in St. Charles County will be located where these two great rivers meet.

This unique opportunity came about due to a public-private partnership, thanks to the generosity of the Danforth Foundation of St. Louis and the assistance of the River Network, a national non-profit river restoration and protection organization based in Portland, Ore. As Phil Wallin of River Network noted, visitors will be able to dip one foot in the Missouri, one in the Mississippi and look out and feel the history of America between their toes.

In addition to the 202 acres at the confluence point, River Network purchased an additional 872 acres adjoining the new state park. We will provide the leadership in working with the River Network to find sources of funding to bring the rest of this land into public ownership. The Danforth Foundation provided an interest-free loan so that River Network could buy and hold this additional land until a donor could be found.

The confluence park is a significant site not only for Missouri, but also for the country, both historically and geographically. It has been our goal to preserve this site and provide access for people so they can appreciate the significance of it. This area played a key role in the westward expansion of the United States.

We will begin developing access to the park this year, including an entrance road and a system of trails to take visitors to the confluence itself. There will be opportunities for nature study, wildlife observation, photography and river-related recreation. Interpretation of the area will be achieved through signs and on-site programs. The interpretation will include information about the Lewis and Clark Expedition, which will celebrate its 200th anniversary in 2004.

An additional benefit of the park will be its proximity to St. Louis. The park is only about 15 miles north of downtown St. Louis, so almost 2 million people live within an hour's drive of it. The announcement also is welcome news for Missouri's birding community because this area is used by millions of migratory birds each year.

We'll keep you posted on the park's development. In the meantime, I hope to see you at one of our other 81 state parks or historic sites this spring as you get out and enjoy the sunshine!

Steve Mahfood,  
Missouri Department of Natural Resources



## **Composting Gives Nature a Nudge**

Backyard composting helps nature convert waste into worth. By setting aside a small corner of their yards to compost grass clippings, leaves, twigs and some food scraps, homeowners reduce the volume of waste bound for collection centers and create their own nutrient-rich humus.

Materials that can be placed in a backyard compost pile include flowers, non-spreading weeds, wood chips and, when there is no danger of attracting pests, scraps such as eggshells and coffee grounds. Materials to be left out of compost piles include meat, cheese, treated lumber and diseased plants.

### **Composting takes place in passive or active bins.**

Passive bins can be built using snow fence or chicken wire fastened in a circle or old wooden pallets joined together in a rectangle. Place the unit where it is convenient and add grass, leaves or garden materials that have been chopped or shredded.

Active bins require greater effort but produce higher-quality compost in a shorter time. Three holding units are constructed using wood, wood and wire, or concrete blocks. Fill one bin with waste and then chop and moisten the layers to create hot compost. After five to 10 days, when the heat drops substantially, turn the pile into the next bin and start a fresh pile.

Plans for passive and active bins are available at [[www.dnr.mo.gov/alpd/swmp/pubs-reports/publist.htm](http://www.dnr.mo.gov/alpd/swmp/pubs-reports/publist.htm)] or call the department's Environmental Assistance Office (EAO) at 1-800-361-4827.

# Answers From Above

## Satellites Relay Groundwater Data

by Jim Vandike

Near Dresden, a small community a few miles west of Sedalia in



An observation well is drilled at Springfield to help keep tabs on groundwater levels in the region. DNR photo by Jim Vandike.

Pettis County, a large poultry-processing facility consumes nearly 700 million gallons of groundwater each year, produced from three wells 800 to 1,400 feet deep. The business provides hundreds of jobs for area workers and adds millions of dollars to the local economy. However, nearby residents who rely on groundwater produced from private supplies are concerned that their much shallower wells will not withstand the competition for this precious and finite resource.

A mile west of the processing plant, alongside the playground at Pettis County R-12 School, sits a shiny steel box atop a newly drilled well. Every 30 minutes, a computer-controlled instrument measures and records the depth to the water. Beside the box is a 10-foot steel pole supporting a small radio antenna and solar panel. The panel provides the modest amount of electricity the installation needs and keeps its battery charged. The antenna is angled above the horizon about 41 degrees to the southeast. It points at the Geostationary Operational Environmental Satellite (GOES) some 22,000 miles above the equator, above the northwestern coast of South America.

For a one-minute time window every four hours, the GOES-8 satellite listens only for the data from a particular observation well. The satellite's high-gain antennas and sensitive receivers can distinguish between the weak UHF signal it receives from the Dresden installation and the ever-present background electrical noise. A moment later the water-level data is rebroadcast to Earth where it can provide nearly instant answers for many groundwater-related questions (see sidebar).

An expansion approved by the Missouri Legislature in 1999 has ushered in this new era in groundwater-level monitoring in Missouri. These state-of-the-art data collection stations are replacing the aging mechanical and digital recorders that have been the backbone of the Missouri Department of Natural Resources' groundwater-level observation well network for nearly five decades. The fully electronic recorders have one feature that the older ones did not: nearly instant worldwide access to the information. Keeping tabs on groundwater levels is like checking the oil in a car. If you never check it, you might be lucky and never have a problem. However, if the oil level falls too low, the first sign of trouble may not be noticed before it is too late. Water wells, like engines, are expensive. A well that goes dry because of water-level decline is pretty useless, unless you need an awfully deep posthole. There is little you can do except deepen the well, or drill a new one.

"This is a very exciting time for the department. The groundwater-level data has always been a valuable historic record, but now it can be used as a daily monitoring and water management tool," said Steve Mahfood, Department of Natural Resources director. "Anyone with Internet access, whether at home, at work, at school or in their public library, can get groundwater-level information that was collected within the last few hours."

The key to this is a small UHF radio transmitter nestled within the data recorder. A meager 7 watts of radio frequency power transmitted from the unit, which is a little more than a standard CB radio, is easily received by the GOES-8 satellite.

The department has an agreement with the U.S. Geological Survey, which already has the equipment to receive the data from the satellite, process it and automatically update the Web site. Previously, data charts and tapes were removed from the observation wells manually every six to 12 weeks. Now, new data is received and posted about every four hours. In addition to the new monitoring equipment, the network is being expanded to 70 wells. Eight new wells were drilled in locations where water-level information is critically needed and where existing, unused wells could not be located. Another 16 wells were donated or loaned to the department for use as groundwater-level observation wells by cities or other interested parties.

New observation wells soon will be in or near Columbia, Mexico, Shelby, West Plains, Ozark, Springfield, Warrensburg, Eureka, Camdenton, Quin, Farmington, Lebanon, Cassville, Theodosia, Dresden and Troy. Several other new wells are tucked away in more rural areas, away from the influence of municipal wells.

Groundwater is a resource that continues to gain more widely recognized importance. Worldwide, about 95 percent of the available freshwater is groundwater. Water-use information reported to the department by registered major water users in 1999 showed a statewide groundwater use of about 267 billion gallons. To be considered a major water user, the person or other entity must have the capability of producing more than 100,000 gallons of water per day. That value, therefore, does not reflect the groundwater produced from thousands of smaller-capacity wells currently in use. It is safe to say that the actual annual groundwater use by Missouri is substantially greater than 267 billion gallons.

For more information concerning water users registration, contact The Water Users and Economics Unit, Geological Survey and Resource Assessment Division, P.O. Box 250, Rolla, MO 65402.

The competition for Missouri's water also increases each year, and with it can come accusations, disputes, even lawsuits. When cities, businesses and farms use large amounts of water, questions arise. The water users want to know if the volume of water they seek is available. Their neighbors want to know if the

pumping will hurt their ability to access groundwater. The Department of Natural Resources has been answering questions like these since the agency was formed in 1974. Even before then, the forerunner of the department's Geological Survey and Resource Assessment Division was collecting and distributing groundwater information.

"Our groundwater-level observation well network dates back to the mid 1950s," said Mimi Garstang, Geological Survey and Resource Assessment Division director and state geologist. "We have almost 45 years of nearly continuous groundwater-level data for many sites in the state because of the efforts of several generations of geologists and hydrologists. This information will be even more important in the future as development places greater stress on the state's groundwater resources," Garstang added.



The groundwater-level data collected from the observation wells serve many purposes. More than 40 years of data from a half-dozen observation wells in the southeastern lowlands of Missouri show that despite intense agricultural irrigation, there has been no significant decline in groundwater levels in most of the area. However, rice production continues to increase in the region, and that crop requires considerably more water than most other small grains and fibers. A newly drilled observation well near the town of Qulin in Butler County will help rice farmers monitor the effects of their irrigation. On the opposite side of the state, an unused municipal well in the town of Noel in McDonald County shows a great change in groundwater level. When the 840-foot deep well was drilled in 1931, it was a flowing artesian well, discharging water at about 56 gallons per minute. Today, the water level has dropped to about 350 feet below land surface. The decline is due to several factors, including water usage in adjacent parts of Oklahoma, possibly Arkansas, as well as municipal and agricultural water use from Missouri wells.

About 60 miles northeast of Noel in eastern Barton and western Dade counties, agricultural irrigation is a common practice. Wells 1,000 to 1,200 feet deep generally can produce 1,000 to 1,500 gallons of water per minute from the Ozark aquifer. The same aquifer supplies all of the towns, water districts, and many of the private supplies. The town of Golden City has several irrigation wells nearby. The irrigation season typically begins in late June and ends in early September. Still, during that short time, considerable water is produced from the Ozark aquifer. During the summer of 1999, seven irrigation wells within about three miles of Golden City reportedly produced 616 million gallons of water. In contrast, Golden City used a little more than 30 million gallons of water during the same year. Golden City well No. 1 was converted to a groundwater-level observation well in early 1996. Data collected there shows that the groundwater level in Golden City fluctuates about 5 feet daily due to the city's own wells, but drops sharply at the onset of local irrigation and declines as much as 70 feet before irrigation ends. Fortunately, for now, groundwater levels in the area recover nearly completely before the next irrigation season begins.

The groundwater-level monitoring expansion will increase the size of the network by about 50 percent. All of the new wells have been drilled and as of Nov. 15, 2000, the new equipment had been installed on 50 of the observation wells. Nearly 70 wells should be on line by the end of the year. Other wells will be added as needed, but probably not more than one to two wells per year.

Soon, not only will people be able to just look at the data, but they will also be able to learn about which aquifers the wells monitor, the local geology and the historic water-level trends in the area. The information will be of special interest to schools. Science students statewide will be able to learn more about water supplies in their areas, and in many cases be able to monitor water-level fluctuation caused by the wells that serve them. This information will be available on the department's Web site when the project is complete.

Current Missouri groundwater-level data can be accessed on our Web site at [[www.dnr.mo.gov/water.htm](http://www.dnr.mo.gov/water.htm)]. Click on "current groundwater conditions" and follow the instructions to view observation well data.

Jim Vandike is a registered geologist and chief of the Groundwater Geology Section within the Department of Natural Resources' [Geological Survey and Resource Assessment Division](#).

### **Satellites and Solar Panels GOES Goes Nowhere (at 6,800 mph)**



The GOES (Geostationary Operational Environmental Satellite) satellite is a 4,600-pound unit whose sensors, transponders, and other major components are mostly contained within a 7-foot cube. The solar panels and radio antennas deploy after the satellite is safely in orbit giving the craft an operational length of about 88 feet. GOES satellites have been orbiting the Earth since 1968 as part of a program conducted by NASA and the National Oceanic and Atmospheric Administration. As needed, aging GOES satellites are replaced. Currently, GOES-8 and GOES-9 are in geostationary orbit above the equator. Combined, their imaging packages can view 60 percent of the Earth's surface and supply the weather data and images most television stations use for their weather broadcasts. Plus, the satellites monitor space conditions that can affect weather, radio broadcasts and satellite transmissions. They have more than 100 data channels used to transfer environmental data from remote stations. Each satellite has an average operational life of about five years. GOES-8 and 9 have been in orbit longer than this and are still functioning. GOES-10 and 11 already are safely in orbit and ready to replace either of the aging satellites when necessary. The satellites move through space at a speed of about 6,800 miles per hour and orbit the Earth once each day. Because they are traveling the same direction that the Earth rotates and are directly above the equator, they remain in the same geographic position in relation to Earth.

### **Solar Panels Now Powerful, Practical**

Photovoltaic panels contain solar cells that directly change sunlight into electrical energy. A typical 4-inch silicon solar cell produces about 1.5 watts of electricity at noon, so numerous cells are linked together in a solar panel to provide the required voltage and current. They have been widely used to power space vehicles for many years, but were once considered too expensive for most Earth-bound power-supply applications. No longer the case, today's photovoltaic panels are used as a renewable power source for everything from phone systems to home outdoor lighting.

Powering the department's new generation of groundwater-level monitoring stations is one of these cost-effective uses of solar power. The large 9-volt dry cell batteries formerly used to power the digital groundwater-level recorders lasted about 12 months when the recorders were new, but after 20 years of service the recorders consumed considerably more energy. Few would operate much more than six months before needing battery replacement. Some even required new batteries every few weeks. Because the manufacturer had discontinued supporting the digital recorders, obtaining new parts when needed was not an option.

The photovoltaic panels and 12-volt rechargeable batteries that power the new equipment obviously cost more than a 9-volt dry cell battery. However, the installations also use more power to operate than the old recorders, so they would require even larger capacity power supplies. The new panels will produce about 19 watts of power at 12 volts under bright sunlight at noon on a summer day while less power is produced early and late in the day, under cloudy conditions, in shade or during winter months. The panels are large enough that only a few hours of sunlight every few days are necessary to keep the batteries fully charged. If a solar panel malfunctions, a fully charged battery will power the installation for about a year. This allows time for repairs to be made without the risk of any loss of data.

Over time, the photovoltaic panels and rechargeable batteries should prove more economical than using nonrenewable dry cell batteries. Fewer maintenance visits will be needed and significant savings also will be realized by avoiding the loss of data seen with the older dry-cell-powered system.

The cost of the photovoltaic panels and batteries is small when compared to the value of the information they help to collect, and lost data are irreplaceable. Because battery condition and signal strength data are sent along with water-level data every four hours, it is easy to monitor the condition of the electrical system and fix power supply problems before they can cause a loss of data. A U. S. Department of Energy special state energy program grant obtained by DNR's Energy Center helped to defray the cost of the photovoltaic panels and rechargeable batteries.



## Letters

Thank you for the magazine, *Missouri Resources* Vol.17, No. 4. I read it from cover to cover. And I also thank your Division of State Parks for the 250 copies of the booklet, "Missouri Equestrian Trail Guide."

As acting trail boss for the Cardiac Cowboys, we were in charge of the Haven House Trail Ride. We handed out over 200 copies of the equestrian booklet. We have given out around 40 copies to folks who come to ride with our two riding groups, the Cardiac Cowboys and the S.E.M.O. Trail Riders. We do have people from all over the world come ride with us.

I am enclosing a subscription card for my grandson and myself so we can receive your magazine.

Aubrey Christie  
Poplar Bluff

Editor's Note:

*The "Missouri Equestrian Trail Guide" shows where you can ride in Missouri state parks. To receive a copy, call 1-800-334-6946 and select "0." Tell the operator you would like a copy. Or contact the Division of State Parks through [e-mail](#).*

In reading the article on Mr. Henry Buehler in the Winter 2000-2001 issue of *Missouri Resources*, on page 15 it is stated that Gov. Forrest Donnelly gave the eulogy at the funeral of Mr. Buehler. Correct me if I am wrong, but shouldn't it read Gov. Forrest Donnell?

Frank C. White  
Piedmont

Editor's Note:

*You are correct. Forrest C. Donnell was Missouri's governor from 1941-1945. Phil Donnelly was the governor from 1945-1949. Mr. Buehler died in 1944 and Gov. Donnell gave the eulogy, not Gov. Donnelly.*

The story of Gen. John J. Pershing's boyhood home by Margaret Neeley (Winter 2000-2001) brought back memories from the late '50s and early '60s. My dad was one of the carpenters who remodeled the Pershing home for the state. I can remember the porch columns that he built in our home at Brookfield and also the fireplace mantle was built in our home and installed in the Pershing home. He kept the original walnut mantle for years in hopes the state would want it to be put back in the home. My dad worked two or three months on the house. He had taken great pride in the home and what it stood for. There also was part of an old cabin there back in the '60s. This is part of the history of our country and should be completely restored.

I love reading copies of *Missouri Resources*, keep up the good work.

Franklin Smith  
Buffalo

Editor's Note:

*In January, the Department of Natural Resources began an extensive project to restore the house to more closely reflect the 1870 to 1880 period when Pershing lived in the home. This project should be completed in June and we hope you will have a chance to visit the home and see the modifications.*

Recently you published a photo from "Lake of the Ozarks: The Early Years," by Dwight Weaver (Time Exposures, *Missouri Resources*, Winter 2000-2001). I would like to purchase a copy of this publication. Do you have a phone number or address for him or a contact person?

Jeff Baker  
Fenton

Editor's Note:

*To contact H. Dwight Weaver or to obtain a copy of the book, call Arcadia Publishing at (888) 313-2665 or via e-mail at [jsteiner@arcadiapublishing.com].*

Thank you for providing a reasonably balanced view of environmental issues and solutions. Keep up the good work.

R. Charles Stevens  
Des Peres

Letters intended for publication should be addressed to "Letters," *Missouri Resources*, P.O. Box 176, Jefferson City, MO 65102-0176 or faxed to (573) 751-7749, attention: "Letters." Please include your name, address and daytime phone number. Space may require us to edit your letter. You also can \_\_\_\_\_



## News Briefs

### Earth Day Events Appeal to Students



An Environmental Survivor game, American Indian storyteller, birds of prey and a historical impersonator of Daniel Boone will all be part of the Missouri Department of Natural Resources' Earth Day 2001 celebration.

This is just a sample of the entertainment lined up for the event, which will be held from 10 a.m. to 3 p.m. April 20, on the Missouri State Capitol grounds. Entertainment will include historical impersonator Patrick Lee, demonstrations by the World Bird Sanctuary, American Indian storyteller John Hernandez and Environmental Survivor, a game in which contestants compete for prizes.

The department will honor the late Gov. Mel Carnahan's commitment to preserving Missouri's natural resources. Schools will be encouraged to make environmental pledges.

Opening ceremonies will include an All-Species Parade. Classes are invited to create costumes for their teachers to model with a prize for the best costume.

In conjunction with the event, the department sponsored a slogan contest for fifth-graders from across Missouri. Alexandra Richardson, 11, of Marthasville, won with the slogan "Let Every Day Be Earth Day." She received a \$100 savings bond, donated by Union Planters Bank in Jefferson City.

The department also will participate in Earth Day events in St. Louis, Kansas City and Springfield. Visit [[www.stlouisearthday.org](http://www.stlouisearthday.org)] for more information about other Earth Day activities in St. Louis.

The Division of State Parks will host Earth Day activities in Sam A. Baker State Park in Patterson, Washington State Park in DeSoto, Onondaga Cave in Leasburg, Harry S Truman Birthplace State Historic Site in Lamar and Roaring River State Park in Cassville. Visit our Earth Day 2001 Web site at [[www.dnr.mo.gov/earthday](http://www.dnr.mo.gov/earthday)] for information.

### Unionville Company Receives Grant

TICO Manufacturing has received \$50,000 in financial assistance from the Missouri Market Development Program. The Unionville company recovers and recycles wood pallets. During the past year, TICO has rebuilt more than 15,000 tons of wooden pallets and is the largest pallet supplier in north-central Missouri.

The assistance purchased equipment to make new products, such as wood mulch and animal bedding. The new equipment will allow TICO to recover an additional 2,600 tons of wood waste each year and create two new jobs within the company.

The Market Development Program is based in Jefferson City and is administered by the Environmental Improvement and Energy Resources Authority (EI ERA), a financial arm of the Department of Natural

Resources. For information about recycling markets or project assistance, call the program at (573) 526-5555.

### **Database Plots Missouri's Springs**

Springs are among Missouri's most cherished natural resources and many are sites with historical significance. The department's Geological Survey and Resource Assessment Division now has a single database that locates 3,972 springs in the state.

During the past several years, geologists, hydrologists and other department staff have consolidated data sources to create one large centralized spring database.

Through the use of computer technology, the latitude and longitude of the springs have been updated into decimal degrees.

Other important information about the springs, such as rate of flow, also has been added and the database has been converted to a Geographic Information System (GIS) format.

### **Confluence Becomes Newest State Park**



The confluence of the nation's two greatest rivers – the Missouri and Mississippi – will become Missouri's newest state park.

The acquisition of the 202 acres at the confluence in St. Charles County was made possible through the cooperation of the Danforth Foundation in St. Louis and River Network from Portland, Ore. The Danforth Foundation awarded River Network a grant for \$668,000 to acquire the land. In turn, River Network transferred the land to the Missouri Department of Natural Resources. The Danforth Foundation also gave \$275,000 to the department for site development.

The site will be preserved for its historical and geographical significance. Development will include an entrance road and a system of trails to take visitors to the confluence itself. Interpretation will include information about the Lewis and Clark Expedition, which will celebrate its 200th anniversary in 2004. Work to provide access to the park is expected to begin this year.

In addition to being a priority site for the state's Lewis and Clark Bicentennial celebration in 2004, the confluence complements regional efforts to preserve open space and develop area trail systems.

### **Web Site Available to Report Dumping**

You now can report illegal dumping online at [[www.dnr.mo.gov/alpd/swmp/homeswmp.htm](http://www.dnr.mo.gov/alpd/swmp/homeswmp.htm)]. This Web site allows anyone with Internet access to report open dumping to the Missouri Department of Natural Resources. Links to the reporting forms also are available on the department's publications and Environmental Assistance Office (EAO) Web sites.

The department will monitor the Web site regularly and forward information to the appropriate regional offices. Staff will investigate these complaints and take appropriate enforcement action to deter further dumping.

As a concerned citizen, you may be contacted for more information, but you can remain anonymous during the enforcement action by not providing identifying information on the interactive complaint form. If you request it, you will be notified of the outcome of the investigation.

For information, contact the department's [Solid Waste Management Program](#) at 1-800-361-4827 or (573) 751-5401.

## **Katy Trail Ride Registration Open**

Take a five-day ride on the longest developed rails-to-trails project in the nation during the Take a Ride on the Katy June 18-22. Sponsored by the Missouri Department of Natural Resources, the 242-mile ride will be offered on Katy Trail State Park with a side trip to Columbia on the MKT Trail. Along the way, cyclists can camp outdoors and enjoy natural and cultural features, such as wildlife, areas of prairie and wineries. Breakfast and dinner will be provided daily along with gear shuttle, portable hot showers and planned activities at each stop.

For more information or a registration form, call 1-800-334-6946 or [e-mail](#). The Take a Ride on the Katy takes the place of the annual Cycle Across Missouri Parks (CAMP), which will not be held this year.

## **Outreach Office Director Honored**

The Environmental Protection Agency (EPA) recently selected Julianne Stone, director of the Missouri Department of Natural Resources' St. Louis Urban Outreach Office, to receive a Partnership Award. Stone was among the recipients honored Jan. 10 at the EPA Region 7 awards ceremony in Kansas City. Her cooperative efforts with EPA and St. Louis-area government, business and community organizations to implement environmental projects in St. Louis earned Stone the award.

A former policy assistant to the mayor of St. Louis, she is credited with shaping the city's Abandoned Building Demolition Project and has been an advocate for the EPA and city's Brownfields Program. Stone has promoted the redevelopment of brownfields and helped plan and execute last year's Brownfields Earth Day celebration.

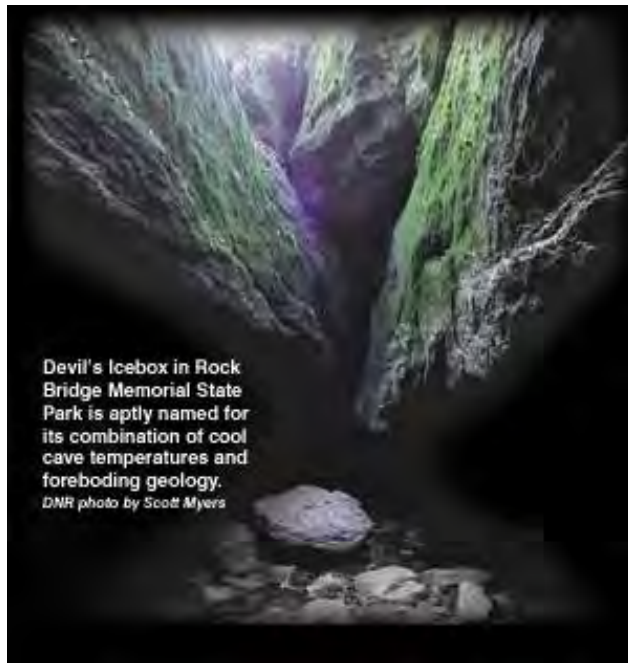
In her new role as director of the Urban Outreach Office, Stone assists EPA staff in making local contacts and planning meetings and has helped the Community Air Project find and lease space for air monitoring equipment. As a member of the Household Hazardous Waste Task Force, she also is helping find solutions for the management of hazardous waste.



## One Last Word

### Speak of the Devil

by H. Dwight Weaver



Would you like to tell someone to "go to the devil?" Well, if you live in one of eight Missouri counties north of the Missouri River, you can do even better – you can tell them precisely *where* to find the devil. If you live south of the river, you have your choice of sites in 35 counties. That is because there are so many natural landscape features of the state that have been named for his highness of hotness.

Old Soot seems to have spent a great deal of time in Missouri. He has left parts of his *backbone* (sharp narrow ridges) in 25 counties, *horn* (a stream valley and a mound) in Carter and Worth counties, and *elbow* (a sharp river bend) in Pulaski and Butler counties.

He is a sporting fellow, too, because you will find his *racetrack* in Christian County (limestone fissures) and his *run* (a stream valley) in Carter County.

"A large portion of the territory of Missouri ... is still recognized as the property of the devil, if place names are sufficient evidence of ownership," said Robert L. Ramsay in "Our Storehouse of Missouri Place Names" (1952). Ramsay listed a number of sites and said that the devil made his presence known in Missouri nearly 200 years ago. He did so by getting his name in the journals of the Lewis and Clark Expedition for May 24, 1804, when they recorded the *Devil's Race Ground*, a difficult rapid in the Missouri River.

The late Thomas (Tom) R. Beveridge, former Missouri state geologist and the author of "Geologic

Wonders and Curiosities of Missouri" (1978, revised 1990), recorded more than 85 geologic sites named for the devil. "Settlers from the Appalachian highlands were largely Scotch-Irish in their background and their concern with the devil was undoubtedly ... a result of Calvinistic influences rather than familiarity with the legend of Faust (the 16th-century doctor who sold his soul to the devil)," he wrote in his book. "No cases of natural surface features involving angels were found."

The devil, you say!

It appears that the devil owns seven parcels of real estate in Shannon County, more than in any other county. Following on its heels are Iron, Carter and Pulaski, each with four fiendish sites, while six counties have three sites each, and 11 counties have at least two areas. Each of the remaining counties have but one site.

From the list of sites, one has to conclude that the devil eats well and entertains often in Missouri for this diabolical fellow has three *kitchens*, four *tea tables*, a *dining table*, a *bake oven*, two *iceboxes*, a *kettle*, a *punch bowl* and a *sugar bowl*. And, despite his reputation for sloth and foulness, he must stay pretty clean. He has a *washbasin*, two *washboards*, a *wash pan*, a *pool* and two *wells*.

When the devil is not hiding out in one of his 14 *dens* or *holes* in the state, he can be found lounging in his *courtyard* in Buchanan County or demanding tribute at his *tollgate* in Iron County.

Beveridge maintained that the religious persuasions of our Ozark ancestors are the reason we have such a dastardly digest of devilish domains and an absolute absence of angelic acreage. He also proved his thesis. "This condition," he said, "is in sharp contrast to western United States where the Latin-American influence predominated and features incorporating terms alluding to angels and Heaven are common."

I suppose, then, if you prefer more heavenly retreats, you can follow Horace Greeley's oft-paraphrased admonition and, "Go West, young man, go West!"

*Dwight Weaver is the former division information officer for the Department of Natural Resources' [Geological Survey and Resource Assessment Division](#).*

## Resource Honor Roll



**Bob Berkebile**

Bob Berkebile's parents had a glimpse into their son's future when, as a 6-year-old, he assembled a doghouse using scrap materials. As he grew, so did the scope of his projects. From tree houses to homes, he always utilized leftover construction materials. Today, Berkebile is an international leader in sustainable and environmentally restorative architecture.

While his intentions were good, his decisions were uninformed, he says. Through tragedy came understanding. On July 17, 1981, two walkways at the Kansas City Hyatt Regency Hotel atrium collapsed. The accident killed 114 people and injured more than 200 others. Berkebile was the principal in charge of the firm that designed the hotel.

Joining the rescue team, he wondered if he was to blame. In subsequent years and through ensuing lawsuits he learned the fault lay elsewhere. Still, a larger question formed in his mind: "What is the real impact of what I do on the people I intend to serve?"

He realized that he was making misguided choices about the effect of his projects on the environment – an "awful or wonderful revelation" that influenced every decision he has made since.

Berkebile is the founding chairman of the American Institute of Architects' Committee on the Environment. That organization spawned the U.S. Green Building Council. He was instrumental in developing the Leadership in Energy and Environmental Design (LEED) ratings criteria. He is a member of the Nature Conservancy Board of Trustees, chairman of the Environmental Management Commission for Kansas City, founding member of the Union of International Architects Road from Rio Working Group and co-chairman of the Scientific Advisory Group on the Environment. His company, Berkebile Nelson Immenschuh McDowell Architects, is designing the Missouri Department of Natural Resources' Green Building. The Green Building is a future blueprint for state government facilities utilizing sustainable building practices.



**Elk River Advisory Committee at Newton and McDonald Counties Grazing School**

Volunteers representing a variety of concerns have worked together for the past two years as part of the Elk River Advisory Committee. The committee is charged with guiding the Elk River Water Quality Demonstration Project, which offers information and instruction in a number of conservation techniques. The Elk River Watershed comprises approximately 480,000 acres in southwest Missouri. It includes most of McDonald County and portions of Newton and Barry counties as well as parts of Arkansas and Oklahoma.

The advisory committee reflects the needs of people living within the Elk River Watershed and serves as a sounding board for the project, explained James Watterson, project manager.

The five-year project is funded through an Environmental Protection Agency grant administered by the Missouri Department of Natural Resources. Activities include demonstrating proper livestock and grassland management, riparian corridor restoration and proper septic system maintenance.

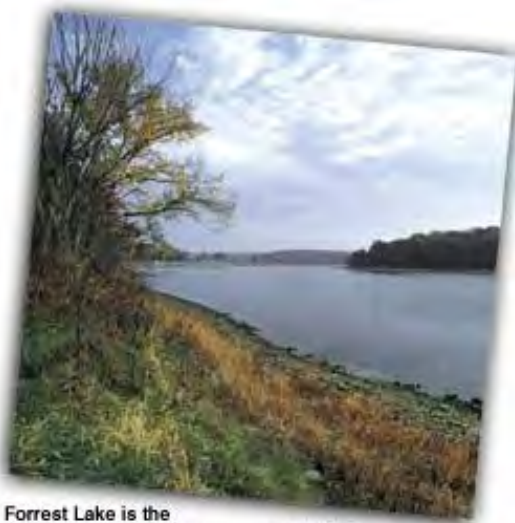
Approximately 35 individuals serve on the advisory committee including landowners, business owners, poultry growers and local, state and federal government representatives.

“The diversity of the committee provides ideas from many different schools of thought,” Watterson said.  
“Their contributions have become very valuable because they are actively involved in the local communities and have a good understanding of the desires and needs of the surrounding area.”

## Resources to Explore

# Thousand Hills State Park

by Jennifer Sieg



Forrest Lake is the  
feature attraction of Thousand Hills State  
Park. DNR photo by Scott Myers

Millions of years ago, thousands of hills were created in northeast Missouri when many rivers and streams cut down into land flattened by glaciers. This action dissected the land, forming a multitude of ridges and valleys. Today, as you travel the roads of northern Missouri near Kirksville, both the hills and the reasoning behind the name of the Missouri Department of Natural Resources' Thousand Hills State Park become apparent. These gently rolling hills interspersed with steep, rugged inclines are covered with a patchwork of woodlands and grassy meadows, creating a diverse park landscape.

Archaeologists believe the area was once part of an ancient ceremonial ground used by American Indians who inhabited Missouri as many as 1,500 years ago. Ancient rock carvings, known as petroglyphs, display images such as crosses, arrows, snakes, thunderbirds and other animals. They were discovered in exposed sections of sandstone along Big Creek, a tributary of the Chariton River. The carvings, which were made by chipping and rubbing into the sandstone, are thought to be symbols that helped ancient tribes remember the order of ceremonial rituals. Today, a shelter in Thousand Hills State Park protects, preserves and interprets these ancient carvings at the site, which is listed on the National Register of Historic Places.

Early American settlers began to call the hills home in the 1800s, eventually mining their clay deposits and coal reserves. Near the end of the 19th century, a young man by the name of George Laughlin moved to Kirksville to study medicine. In addition to his interest in medicine, he possessed an interest in land. He purchased some property on the west side of Kirksville that he called Thousand Hills Farm, which eventually would become a portion of Thousand Hills State Park.

After World War II, Kirksville's growing population created an increased demand for both water and outdoor recreation. Heirs of Laughlin, who had been a longtime supporter of a city reservoir, donated 1,100 acres of his farm for the building of a lake. Additional acreage was purchased, and, in 1951, construction of the lake began with the damming of Big Creek. The land was given to Missouri as a state park in 1953; however, the 573-acre lake remains the property of the city of Kirksville.

Forrest Lake, named for former Gov. Forrest Smith, is the feature attraction of the 3,215-acre Thousand Hills State Park, providing water recreation galore. For the adventure-seeker, the lake's 17 miles of shoreline make it perfect for waterskiing and motorboating (90 horsepower maximum). For people who like to navigate across the water at a slower pace, paddleboats and canoes provide the perfect form of transportation. The park's marina rents paddleboats, canoes, pontoons, fishing boats and speedboats. Accessories such as skis, tubes and knee boards are available to enhance your day on the lake.



American Indian rock carvings, known as petroglyphs, are preserved in a shelter within the park. DNR photo by Scott Myers

For the fisherman, Forrest Lake is stocked with crappie, largemouth bass, bluegill and channel catfish. Anglers can find a quiet cove to cast their lines from a boat or kick back and relax along the shore and await a bite. The marina stocks fishing necessities, such as bait and permits, along with groceries, ice, picnic supplies, firewood, boating permits and gas.

A large sand swimming beach, complete with a lifeguard, provides access to the refreshing, cool waters on a hot summer day. Nearby is a beach house with dressing rooms, showers and a snack bar offering summertime refreshments such as soda, ice cream and hot dogs. A minimal fee is charged for swimming.

On land, nature lovers will observe diversity in the natural beauty of the park. More than half of northern Missouri was once covered in native grasses and woodlands. Today, only remnants remain. Several native species can be found in the park. Controlled burning and selective cutting of some woody vegetation encourages the restoration of woodland and prairie species such as big bluestem, Indian grass, rattlesnake master, blazing star and several types of goldenrods.

Because of the cooler climate in northern Missouri, many plants found here are not characteristic of other parts of the state. The park contains a grove of large-toothed aspen, a northern tree rarely seen in Missouri. Other landscapes include the rolling upland areas, which are covered with second-growth forests of white oak, northern red oak and shagbark hickory with an understory of mulberry, redbud and ironwood, and the bottomland near the Chariton River, which is full of swamp white oak, silver maple, cottonwood and sycamore trees.

Roaming about these areas are white-tailed deer, wild turkey, beaver, raccoon and red fox. Bird watchers will enjoy observing kingfishers, orioles, ospreys and Canada geese. A seasonal park naturalist conducts nature walks and interpretive programs in an outdoor amphitheater for guests interested in these natural

wonders.

Hikers can experience this natural beauty while wandering the hills on a variety of trails that weave their way through the park. For a short hike, Oak, Red Bud and Hickory trails can satisfy your yearning to experience nature. Oak Trail takes visitors one-quarter mile to an overlook, while the slightly longer Red Bud Trail runs along the shoreline of the lake. Visitors transition from a forested hilltop to the lakeshore on the one-half-mile Hickory Trail, which also is used by seasonal naturalists for interpretive hikes to view the typical plants and animals found in the park.

For the ambitious explorer, there is a 2.5-mile loop trail and a six-mile hiking and mountain biking trail that meanders along the shoreline of Forrest Lake before connecting with Thousand Hills Trail. Created as a cooperative project between the Community Betterment Association of Kirksville, and the departments of Natural Resources and Conservation, the rugged Thousand Hills Trail wanders five miles through oak-hickory forest, woodlands and the restored grasslands. It traverses both the Big Creek Conservation Area and Thousand Hills State Park.

After a long day on the water or hiking the multitude of park trails, a return to camp for dinner duty may not sound appetizing. Why not sample the fare available at the park's modern dining lodge? Besides serving a wide selection of excellent food, it provides a relaxing atmosphere with a scenic view of the lake. Reservations are suggested for dinner.

Numerous picnic sites are scattered throughout the park for those who like to pack a lunch and find a secluded spot to enjoy it. Several of these picnic areas are nestled near the lake's shore. For large gatherings, the park has four open shelters, situated near the lake, and one enclosed shelter with electricity. All can be reserved in advance by contacting the park office. Playground equipment is scattered throughout the picnic areas.



Visitors enjoy a refreshing splash in the cool water of Forrest Lake. The large sand swimming beach comes complete with a lifeguard, dressing rooms and a snack bar. Photo by Missouri Division of Tourism

With all there is to do, you may wish to stay and enjoy the park for more than just a day. Scattered among the oak and hickory trees are 27 basic and 42 electric campsites. Camping areas feature water fountains, dumping stations, modern restrooms and hot showers. For those who do not want to sleep under the stars, seven duplex cabins with panoramic lake views are lodging options. Cabins are air-conditioned and heated, and come complete with linens, kitchen utensils, patios with picnic tables and barbecue grills.

Whether planning a week-long family vacation or just a day of water recreation, Thousand Hills State Park will satisfy your craving for the great outdoors. Recreation options, just like the hills, are too numerous to count.

For more information about [Thousand Hills State Park](#), contact the park at (660) 665-6995. For more information on other Missouri state parks and historic sites, call the department toll free at 1-800-334-6946 (voice) or 1-800-379-2419 (Telecommunications Device for the Deaf) or visit our parks Web site at [www.mostateparks.com](http://www.mostateparks.com)].

*Jennifer Sieg is a public information specialist with the Department of Natural Resources' [Division of State Parks](#).*

# RISKY BUSINESS

## MANAGING METHAMPHETAMINE CLEANUPS

by Brad Harris  
photographs by Scott Myers

Imagine a spring day spent exploring one of Missouri's scenic areas with your family or friends. As you enter a shady canopy of large oak trees, you sense an unusual odor and notice the ground is littered with canning jars, milk jugs, cans, bottles, propane gas cylinders and other trash. Suddenly, your eyes begin to burn and tear. Your children begin to cry. You have difficulty breathing. What could it mean?

You have just stumbled upon a clandestine methamphetamine laboratory, and possibly have been exposed to many dangerous chemicals, some of which may be either explosive, caustic, acidic or otherwise risky to handle, store or transport (see sidebar). You should immediately contact your local law enforcement agency and should never touch anything at the site. The police may call the Missouri Department of Natural Resources for technical assistance cleaning up the meth lab.



At a meth lab collection station, city of Jackson Fire Rescue squad members Curtis Sparks and Rob Francis carefully dispose of potentially deadly chemicals – ingredients and byproducts from the manufacture of methamphetamine.

Not long ago near Springfield, neighbors witnessed an explosion deep in some nearby woods. The Missouri State Highway Patrol investigator was called and numerous pressure cylinders containing anhydrous ammonia, including a large buried tank, were found. This led authorities to believe the explosion was related to several meth labs operating on private property. "I knew once we served the search warrant that the cleanup of the meth labs would exceed our capabilities," said Sgt. Mike Cooper of the Highway Patrol. "I knew DNR's Environmental Emergency Response (EER) group could help but I was not sure to what extent. We consulted with them early on and based on what we described, they brought in the resources and equipment to get the job done that day." The department response team brought in an excavator, specialized vehicles, clean-up equipment and supplies, a back hoe, a roll-off box for the solid waste and a crew of 10 skilled contractors.

After the Highway Patrol served the search warrant, secured the 80-acre property and collected evidence, the EER went to work. Nine hours later, everything associated with the manufacture of meth on the property had been removed. Nearly 2 tons of solid waste from manufacturing meth was disposed of properly. More than 100 pounds of suspected hazardous waste was transported to the Sedalia Fire Department Clandestine Drug Lab Collection Station for processing. An underground bunker, a storage building

and a camper used to support the illegal operation were destroyed. Nineteen cylinders of anhydrous ammonia were located and the contents and cylinders disposed of safely and legally.

What Cooper later described as the largest quantity of anhydrous ammonia ever recovered from a Missouri meth lab – a full 1,000-gallon tank – was discovered camouflaged deep in the woods. It had to be carefully removed from the wooded ravine to prevent a catastrophic release or injury. The stolen tank was subsequently returned to its rightful owner in northern Missouri. Cooper said, "DNR came in and got the job done in a quick, safe and efficient manner. Hopefully, I will never need their services again, but if I do, I won't hesitate to give them a call for help."



These tanks were confiscated during meth lab raids. They were not designed to hold dangerous contents – anhydrous ammonia – and pose a dangerous risk of explosion.

To say that Missourians were caught off guard by the rapid increase in the number of meth labs would be an understatement. Many communities had not dealt with significant drug problems before meth. According to a report published by the United States Attorney's Office for the Western District of Missouri, only 37 meth labs were seized during all of the 1980s. What is not known is how many meth labs and users existed during that time but were never discovered. What is known is in 1990 or 1991, California motorcycle gangs began importing meth into Jackson County to sell. However, because of problems and risks associated with transporting meth from California or Mexico, the gangs brought experienced meth cooks to Independence in 1993. The drug rings began expanding into the Kansas City metropolitan area and throughout western Missouri.

As the meth epidemic grew, Missouri officials began meeting in 1994 in an effort to determine the extent of the problem and what to do about it. Fires, explosions, toxic fumes and hazardous chemicals are all inherent dangers at a clandestine meth lab. A public awareness campaign to educate citizens on meth's deadly effects was one result of the meetings. The meth cooked locally usually was readily available, of a higher purity, and highly addictive. To be effective, the prevention program would need to combat meth's reputation as a cheaper, safer and longer-lasting high (as compared to cocaine).

In October 1997, the late Gov. Mel Carnahan hosted the first Governor's Methamphetamine Summit in Jefferson City. In this forum, law enforcement and other officials met to share ideas and develop strategies to combat meth. One outcome was the passage of one of the toughest methamphetamine laws in the country, approved by the Missouri Legislature and signed into law by Carnahan.

Areas of concern identified during the Meth Summit included the escalating costs of responding to and disposing of the chemicals associated with meth labs, the financial impact on law enforcement budgets, the improper and unsafe storage of seized chemicals, the lack of cleanup by property owners and a pressing need for improved health and safety training for law enforcement.

The departments of Health, Natural Resources, Public Safety, the State Highway Patrol, State Fire Marshal's Office, Army National Guard, Office of the Attorney General, U.S. Environmental Protection Agency, U.S. Department of Justice, and several local law enforcement and fire service agencies banded together to form the Missouri Interagency Clandestine Lab Task Force Team. Each agency brought to the table a unique perspective on the problem: criminal aspects, fire risk, hazardous materials, social issues, financial impacts, legal obligations, disposal concerns, training and equipment

needs.

The task force's first goal was to develop a safe, efficient, legal and cost-effective way to manage the hazardous substances from meth labs. Traditionally, remnants of a meth lab were cleaned up by a federally contracted clean-up crew. Unfortunately, the clean-up crew was not always able to respond quickly. Since law enforcement officers had to remain at the site of the seizure until the clean-up crew arrived, overtime expenses incurred by local agencies placed heavy burdens on already lean budgets.

In addition, meth lab cleanups had to meet strict federal requirements in order for the clean-up contractor to respond. Without the money to hire their own clean-up contractors, local agencies were sometimes forced to transport and store meth lab materials in an improper and unsafe manner.

Recognizing this deadly situation, the task force devised a solution – the Clandestine Drug Lab Collection Station Program. The collection stations are specially designed buildings that were made available to any public agency in Missouri that wanted the assistance the task force offered.

The Department of Public Safety funded the purchase of 20 collection stations to provide secure storage of seized meth chemicals. Soldiers from the Army National Guard delivered the collection stations to recipient agencies around the state. With features such as an alarmed fire suppression system, secondary containment, spill control shelving, corrosion resistant paint and electrical grounding, the buildings are a safe place in which any community could temporarily store meth chemicals.

The department's Environmental Services Program provides all the equipment and supplies at each collection station. The supplies range from personal protective clothing to test kits that screen for hazardous chemicals. Drums, chemical neutralizer, packing material and air-monitoring equipment are all items provided to support the local agencies' efforts. The department also has agreed to pay for proper disposal of all hazardous waste accumulated at the collection stations.

When a local agency receives authorization from the department to operate a collection station, the department and the U.S. Environmental Protection Agency (EPA) provide training before the collection station can accept meth chemicals. The EPA also has provided funds to the Department of Natural Resources to support clandestine lab initiatives in Missouri. The EER staff located around the state, process much of the meth lab chemicals delivered to the collection stations. At some collection stations, highly trained fire department hazardous materials teams conduct almost all of the processing.

## Recipe for Meth: Prescription for Death

The ingredients used to cook methamphetamine, including sodium hydroxide (commonly used in drain cleaners), acetone or cookstove fuel, anhydrous ammonia (a fertilizer), sulfuric acid, and ether (starting fluid) can be obtained easily enough, which contributes to the difficulty of apprehending meth abusers.



But it is not just the raw materials that present the risks; the meth lab process ultimately creates even more hazardous waste during production. Related materials normally generated include other ignitable waste, caustic waste (materials such as sodium hydroxide, etc.), and acidic waste (materials such as sulfuric acid, hydrochloric acid, etc.). Other waste materials created involve reactive substances such as sodium, lithium (removed from regular over-the-

counter lithium batteries) and red phosphorus.

The first collection station began operating at the Sedalia Fire Department in October 1998. As word spread that the collection station was serving the needs of not just Sedalia and Pettis County, but also communities as far away as Lee's Summit and Camdenton, interest began to grow. Greg Harrell, battalion chief for the Sedalia Fire Department, speaks highly of the innovative program. "My agency was constantly faced with the challenges of dealing with meth lab chemicals. Without a large budget to properly address the demands of meth labs, our hazardous materials team was always looking for creative alternatives." The collection station program worked well and Harrell and the hazardous materials team took pride in initiating and providing a valuable public service in west-central Missouri.

The Poplar Bluff Police Department was granted authorization in early 1999 for a collection station. Gary Pride, a police department detective, oversees the operations at the collection station. More than 75 meth labs have been received at the collection station since it opened. Pride said, "My agency is really thankful for the support of DNR and the task force. I believe this is the optimum way for law enforcement to safely store and dispose of all the undesirable products of a meth lab."

Randy Behrns, assistant chief at the Kirksville Fire Department, speaks of the benefits the collection station offers his staff, "I was always looking for ways to enhance the skills of our department's hazardous materials technicians. The collection station allows my staff the opportunity to handle chemicals on a regular basis.

"They are able to apply many of the things learned in training during processing of meth lab chemicals. It definitely helps keep their skills sharp. The law enforcement officers we see on a routine basis like how easy and convenient it is to drop off meth labs at our collection station. They are really appreciative of what we are doing," Behrns added. The collection station at Kirksville has received more than 70 meth labs.

There are a total of 15 collection stations authorized in the state. "When you look around, the only two areas where we have yet to locate collection stations are northwest Missouri and the Interstate 44 corridor," according to Jim Long, Environmental Services Program director and co-chair of the task force. Long thinks it is just a matter of time before collection stations are located in these areas and they begin to reap the benefits of the program.

There have been nearly 1,000 meth labs accepted at all of the collection stations. Since the law requires hazardous waste to be managed in specific ways, meth lab cleanups can be very expensive. The Drug Enforcement Administration (DEA) places the average cost of cleaning up a meth lab at \$2,000 to \$2,500. Since the program began in October 1998, contents from 774 meth labs have been disposed of properly. The cost to dispose of the hazardous waste has been close to \$45,000. That equates to a cost of approximately \$58 per meth lab.

Granted, the expense of the buildings, personnel and supply costs to process the meth labs have not been calculated into the equation. However, when compared to the traditional disposal option, coupled with the safety and security issues, the overall cleanup costs associated with the collection station program is a bargain for the Missouri taxpayer.

While the collection station program was being implemented, the EPA began work with the Missouri Department of Health (DOH) to identify possible health risks associated with contamination left behind from meth labs. The EPA collected 159 environmental samples from various locations, including mobile homes, motel rooms, rental homes, private residences and public housing. The sample results showed evidence of common chemicals, such as ammonia and alcohol, used in households as well as meth

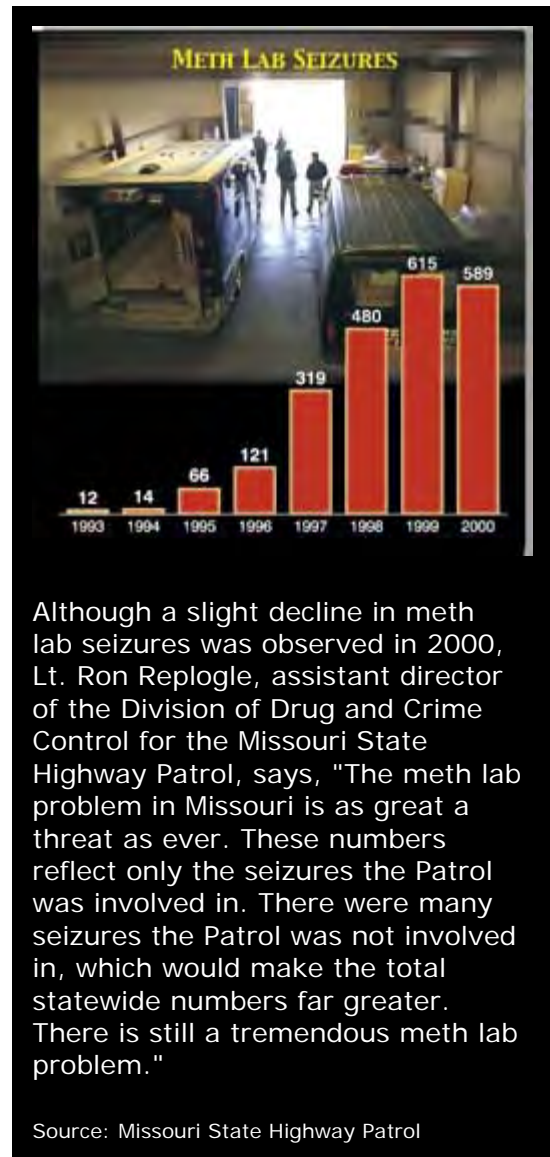
production.

What proved impossible to discern was if the "contamination" was from manufacturing methamphetamine. Pam Holley, DOH environmental specialist, explained, "Since the DOH received so many questions about the cleanup of residences that may have contained a meth lab, our agency developed a document called, 'Guidelines for Cleaning up Former Methamphetamine Labs.' " The answers to the public's questions are now packaged in one brochure that can be obtained by calling the nearest local health department or from the Internet at [www.health.state.mo.us].

While numerous officers attend DEA training programs for clandestine drug labs, the demand in Missouri for such training far exceeds availability. The task force worked with the Highway Patrol, the EPA and the Department of Natural Resources to develop a 40-hour comprehensive health and safety training course focusing on clandestine drug labs. By the end of 2000, more than 170 emergency officials attended and were certified through the training. The training usually is provided at the Highway Patrol Law Enforcement Training Academy in Jefferson City. Officers who attend the course come away with a better understanding and respect for the chemicals associated with meth labs. EPA and the department provide most of the funding for the course. Most students return to their departments with reference materials, a self-contained breathing apparatus, an air-purifying respirator, air-monitoring equipment and a clean-up package for meth labs. Captain James Keathley, director of the Division of Drug and Crime Control for the Highway Patrol said, "We have an obligation to support officers who risk their lives during meth lab encounters to provide them with the very best training, supplies and equipment available so they may return safely to their families at day's end."

Another project endorsed by the meth lab task force that has become a reality is the meth lab response trailers. The Department of Public Safety purchased 25 custom-designed trailers to be used for meth lab seizures. According to Patty Rellergert, program manager with Public Safety and co-chair of the task force, each 16-foot trailer contains two separate compartments. The front of the trailer is an area designed to safely store, secure and transport seized meth lab chemicals to the nearest collection station. The department has provided drums, buckets and containers, packing materials, clean-up supplies, reference materials, air-monitoring instruments, labeling supplies and other items to dismantle and safely transport a meth lab to a collection station. The rear compartment contains personal protective equipment, including chemical resistant gloves, coveralls, shoe covers and self-contained breathing apparatuses.

"The goal of the project was to provide one trailer to ... the 25 law enforcement drug task forces located throughout the state," Rellergert said.

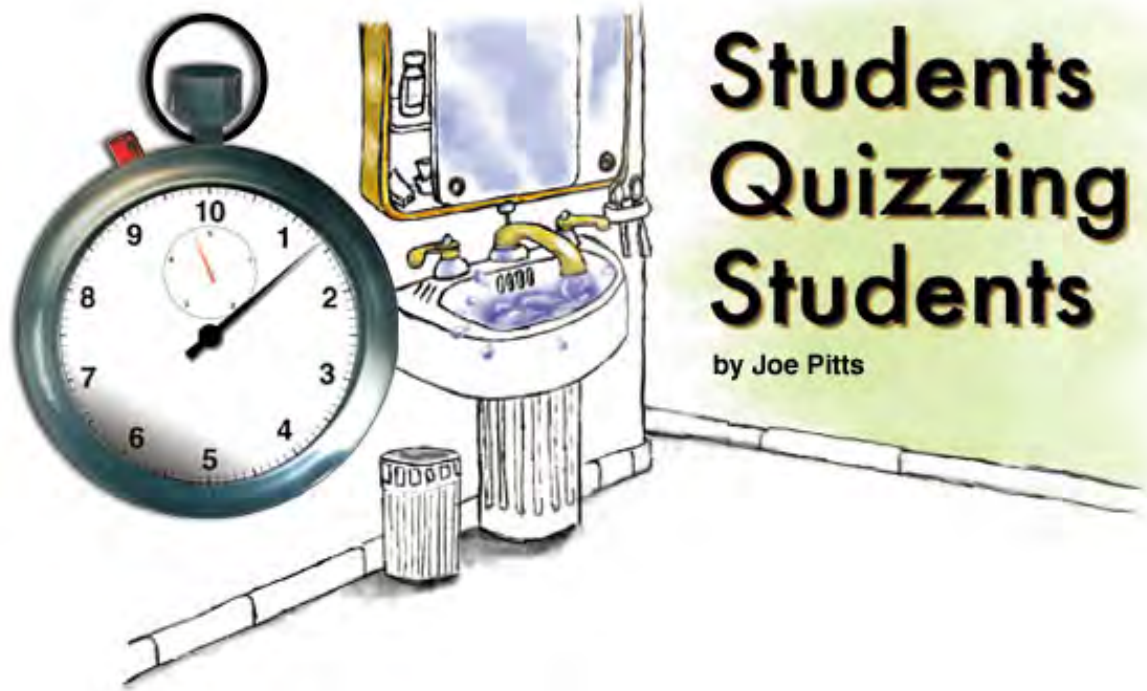


The trailer also contains a 60-gallon water reservoir that feeds the emergency decontamination shower and eyewash station. An onboard generator can power computers, communication equipment, appliances and portable lighting.

Local, state and federal agencies continue to work with the Department of Natural Resources and its Environmental Emergency Response staff to remove the environmental and safety hazards of meth labs. We all should be able to walk anywhere in Missouri, in rural areas and communities, both large and small, without fear, or risk.

*Brad Harris is an environmental emergency response specialist in the [Environmental Emergency Response Program](#) within the Department of Natural Resources' [Division of Environmental Quality](#).*

## Teacher's Notebook



So, you just finished a unit on water and water conservation. How effective was the instruction? Will students use the water conservation practices they have learned? One way to find out is to involve students in actively researching the answers to these questions.

The thrill of discovery is exciting and provides the driving force behind many scientific and social advances. The following activity will acquaint students with the rewards of research and help them develop the skills to investigate water conservation practices and other environmental issues at school, at home and in their community.

### **WATER CONSERVATION DATA COLLECTION / INVESTIGATION**

#### Background

Before students can determine the level of water conservation action in their homes, schools or communities, they must decide what they want to know. This requires them to write a question that can be answered through their original research.

Generally, effective research questions are stated in question form and avoid simple "yes" or "no" responses. In addition, a research question will identify a population or area and the variable to be measured.

For this activity, the research question could be, "To what extent do students of Hometown School practice water conservation?" This sample question follows the guidelines for research questions because it is stated in question form, cannot be answered by a simple yes or no, and identifies the population (students

of Hometown School), and variable (student water conservation practices) to be measured.

The next step is to decide which method of collecting data about the question is appropriate to use. Surveys, questionnaires and opinionnaires are three tools that could be used to assess a particular question. Some questions may require the development of a document that uses all three methods of investigation. The three methods often are collectively referred to as surveys.

A survey involves students in direct observation and data collection. For example, students record information, such as how many classmates turn the water off and on as needed when they wash their hands. A questionnaire consists of student-developed questions or statements that seek information about a specific subject from a selected sample of people (students of Hometown School).

A questionnaire concerning the sample research question above might contain a statement such as, "When I want a glass of water, I let the water run so it will get cold." (1) always, (2) usually, (3) sometimes, (4) almost never, (5) never.

An opinionnaire is similar to a questionnaire but attempts to measure opinions or beliefs of human beings concerning specific topics. If the sample question above were reworded to read, "To what extent do students of Hometown School believe water conservation practices save water?" then an opinionnaire would be the appropriate tool to use.

#### Procedure

1. Divide students into groups (individual research also may be used). Discuss the writing of research questions.
2. Work with the groups (or individuals) to identify a topic (water conservation practices, in this instance) and write a research question.
3. Discuss the various research tools that could be used with the groups (survey, questionnaire or opinionnaire).
4. After discussion, ask students to choose a research tool suitable to their question (questionnaire in this example).
5. Guide the groups in the development of the research tool selected.
6. Ask the groups to develop a research plan (how, when, where and how many people to poll to administer the research tool). Larger samples equal better data.
7. Collect data (implement the research plan).
8. Interpret the data (statistical analysis, tables and graphs).
9. Act as a resource for students as they draw conclusions and make recommendations based on the data.
10. Assign students to report (written and oral) their findings to the class.



Below are a few sample questions that might be included in a questionnaire developed by students to answer the question: "To what extent do the students of Hometown School and their families engage in water conservation practices?"

Hello, my name is \_\_\_\_\_. I am a student at Hometown School. One of my classes is researching water conservation actions. May I ask you a few questions?

1. While brushing your teeth, do you turn the water off and on as needed? (1) always, (2) usually, (3) sometimes, (4) almost never, (5) never.
2. Do you limit the length of your showers to three to five minutes? (1) always, (2) usually, (3) sometimes, (4) almost never, (5) never.
3. Do you wash full loads of laundry? (1) always, (2) usually, (3) sometimes, (4) almost never, (5) never.
4. If you have a dishwasher, do you wash full loads of dishes? (1) always, (2) usually, (3) sometimes, (4) almost never, (5) never.
5. When cleaning the sidewalk, do you sweep it instead of hosing it down? (1) always, (2) usually, (3) sometimes, (4) almost never, (5) never.

The possible questions are unlimited. The length of student questionnaires will be determined by the amount of information sought. Generally speaking, less is better. Their findings may surprise the students.

Discovering knowledge through active research is one method of facilitating students' interest in environmental issues. It also is a sure way to enhance students' interest in science, social studies, math and language arts. In addition, developing their conclusions and findings enables students to discriminate between inferences and conclusions. What better way to help students understand the scientific method?

The Missouri Show-Me Standards require that students develop critical thinking skills. Designing, conducting, interpreting and presenting their own authentic research is one approach to helping students meet the challenge of academic excellence. Environmental issues make timely and relevant subjects for student research. The learning achieved cuts across the curriculum and as a bonus, students may become

hooked on the thrill of discovery.

*Joe Pitts is an environmental education specialist with the Department of Natural Resources' Technical Assistance Program within the [Division of Environmental Quality](#)*

The Vital Ste. Gemme Beauvais House is considered one of the significant buildings within Ste. Genevieve, Missouri's oldest permanent European settlement. Ste. Genevieve is renowned for its examples of French colonial architecture. The house is noted for its post-in-ground construction. It is one of only three such houses remaining in the community which has been designated a National Historic Landmark historic district. The large French Creole structure at 20 S. Main St. was built around 1792 for Vital St. Gemme Beauvais, a French Canadian, and his wife, Felicite Janis. The house is within walking distance of the Department of Natural Resources' Felix Valle House State Historic Site. The brother of Ste. Gemme Beauvais built the Amoureux House, one of the three houses within the Felix Valle Historic Site. This photograph (circa 1900) was supplied by the department's Historic Preservation Program.



Send your photo to: Time Exposures, c/o Missouri Resources, P. O. Box 176, Jefferson City, MO 65102-0176. All pictures will be returned via insured mail. Pre-1970 environmental and natural resource photos from Missouri will be considered. Please try to include the time and location of the picture, a brief description and any related historic details that might be of interest to our readers.